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Latent Lobster Fishing Effort Along Nova Scotia's Atlantic Coast

By

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Abstract

Little data were available that would permit an estimate of both the real fishing effort and its distribution along Nova Scotia's Atlantic coast. Thus a survey was carried out during 1982/83 with 15% (randomly chosen) of the total lobster fishermen. The counties covered were Queens, Lunenburg, Halifax, Guysborough, Richmond, Cape Breton, and Victoria. Thirty-five questions were asked covering such topics as fishing gear quality and quantity, number of days fished yr^{-1}, bait type, etc. Fishermen in all counties but Victoria estimated that recent catches had increased markedly. This phenomenon prompted some to recommend an increase in fishing effort. Fisheries scientists have recommended a conservative approach until more is known about lobster population biology and natural history. Furthermore, the survey has shown that considerable latent effort exists within the fishery: 5% of the licenced fishermen did not prosecute the fishery; 25.7% of the maximum legal number of lobster traps were not employed; and 18.2% of the legal number of fishing days per season were not used. There is also potential to increase fishing power by upgrading present equipment, by acquiring additional electronic and mechanical aids, by increasing manpower assistance, and by improving bait quality. Both present and latent fishing effort and fishing power will be more than sufficient to maintain exploitation rates at traditional levels.

Résumé

On possède très peu de données permettant d'estimer à la fois l'effort réel de pêche du homard et sa distribution le long de la côte atlantique de la Nouvelle-Ecosse. Pour cette raison, on a mené en 1982/83 une enquête auprès de 15 % (pris au hasard) de tous les pêcheurs de homard. Les comtés couverts ont été ceux de Queens, Lunenburg, Halifax, Guysborough, Richmond, Cap-Breton et Victoria. L'enquête comprenait 35 questions sur des sujets tels que la qualité et la quantité des engins de pêche, le nombre de jours de pêche par $année^{-1}$, le type de boëtte, etc. Les pêcheurs de tous les comtés, sauf Victoria, ont exprimé l'opinion que les prises récentes avaient augmenté notablement. Ce phénomène a incité certains à recommander que soit intensifiée l'effort de pêche. Les scientifiques halieutiques, pour leur part, recommandent une approche conservatrice tant qu'on n'en connaîtra pas davantage de la biologie et de l'histoire naturelle des populations de homards. L'enquête a de plus démontré qu'il existe dans cette pêcherie un effort latent considérable : 5 % des détenteurs de permis ne pêchent pas; 25,7 % du nombre de casiers maximal permis ne sont pas utilisés; et 18,2 % du nombre de jours de pêche permis par année ne sont pas employés. Il y a de plus potentiel pour augmenter la puissance de pêche : amélioration de l'équipement, aides électroniques et mécaniques supplémentaires, expansion de la main-d'oeuvre, amélioration de la qualité de la boëtte. L'effort de pêche, tant actuel que potentiel, est plus que suffisant pour maintenir les taux d'exploitation à leurs niveaux traditionnels.

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Introduction

Independent assessments of lobster abundance over the thousands of miles of coastline in the Scotia-Fundy Region are difficult to produce for this resource. Finfish biologists tend to use catch per unit of effort (CPUE) as a measure of stock density (Cushing 1981). The CPUE data are derived from logbook data, required under law, to be recorded by vessel captains. A logbook system is deemed impractical for inshore fisheries (Anthony and Caddy 1980; Conan and Maynard 1983). Other indirect methods have recently been employed which involve remote sensing (Conan and Maynard 1983; Pringle and Duggan 1983). However, information on latent or potential fishing effort, fishing power, fishing success, etc. cannot be derived in this manner. Consequently, a study, based on fishermen interviews, was implemented along Nova Scotia's eastern and southern shores.

Recently, there has been an upturn in fishing success based on lobster landings in all counties of southeastern Cape Breton and the eastern and southern shores of Nova Scotia (Appendix 1). Individual fishermen interviewed confirm this trend (Table 1). Consequently, there have already been three requests for relaxation of the current freeze on new entrants into the fishery and more are expected (Robinson pers. comm.[a]). This demand assumes that there is no ability within the fishery to increase fishing power and fishing effort above current levels. An attempt will be made to test the latter hypothesis with the data base available from our survey.

Concepts and Methods

Fishing effort, in this study, is the total number of traps in use for a specified period (legal fishing season) of time (Ricker 1975). Effort in a specified area (fishing district) can be increased by licence and by fishermen in one or all of the following ways: 1) by all licenced lobster fishermen (hereafter referred to as fishermen) becoming actively engaged in the lobster fishery; 2) by deploying the maximum legal number of traps; 3) by lobstering the maximum legal number of fishing days per season; 4) by upgrading both trap construction and associated gear (ropes, buoys, etc.); 5) by upgrading their vessels, navigational equipment, hauling equipment, and power trains; and 6) by employing that number of deckhands required to efficiently handle the catch. Fishing power is the relative vulnerability of the lobster stock to the fishing gear deployed (Ricker 1975). Ways fishermen can increase fishing power are as

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follows: 1) by using the minimum soak time that yields maximum CPUE; 2) by using preferred bait (quality based on type and freshness); and 3) by placing traps in such a way as to maximize CPUE.

A 35-point questionnaire covering certain aspects of the lobster fishery such as demographics, status, capital equipment, level of effort, and personal opinions was developed (Appendix 2). To determine the number of lobster licence holders in the area of interest, a list of fishermen to whom lobster licences had been issued in 1982 was obtained from the Scotia-Fundy Licencing Unit, Fisheries Operations Branch, Department of Fisheries and Oceans. A minimum of 15% of the fishermen were to be interviewed and were chosen via random numbers as follows. The master list of 1,447 fishermen was consecutively numbered. 1,450 random numbers were generated by computer. The first 225 random numbers were matched to the master list creating a second list of randomly selected individuals. The distribution of interview locations is shown in Figure 1.

Each fisherman selected was sent a personal letter advising him of the project, stressing confidentiality, and suggesting a tentative date for an interview. Letters were also sent to fishermen's associations and cooperatives and to regional offices of the Fisheries Operations Branch, advising of the project and requesting cooperation. Selected individuals were contacted by telephone to confirm a time for a half-hour appointment. If contact was not made after three attempts, the next person on the master list having the same licence category was approached as an alternate. Interviews were given on a voluntary basis; no offer of compensation was made.

Interviews were conducted by two Fisheries Research Branch personnel during March and April 1983. The second author organized interviews and trained the other interviewer. Most of the interviews were carried out on a one-to-one basis in the fisherman's residence. The questions (Appendix 3) were asked and answers were recorded by the interviewer. Statistical analyses of data were carried out using the "one-way" and "frequencies" programs of McGraw Hill, Statistical Package for the Social Sciences, second edition.

Results

The fishermen, to a man, welcomed the chance to be interviewed; reception was cordial. It was not uncommon for the interviewers to be offered hot drinks and a meal.

Overall the fishermen were open and candid; the only hesitation noted was during three or four interviews when it was felt by the interviewer that the fisherman indicated he had used more traps than he actually fished. This was probably because

he feared having an "A" licence downgraded or losing a "B" licence for inactivity.

Fishing Effort

1. Maximizing trap number

The number of "A" licences county^{-1} and the maximum legal number of traps that a single licenced fisherman can fish are given in Table 2. Four districts are permitted 250 traps licence^{-1} and two districts are permitted 275 traps licence^{-1}. The mean number of traps fished day^{-1} licence^{-1} county^{-1} ranges from 152 (Queens Co.) to 242 (Cape Breton Co.) (Table 2). The potential total number of traps county^{-1} ranged from 21,550 (Richmond Co.) to 72,500 (Halifax Co.); the estimated number fished ranged from 14,687 (Richmond Co.) to 56,870 (Halifax Co.). The potential for trap increase county^{-1} ranged from 12.0% (Cape Breton Co.) to 39.3% (Lunenburg Co.). The total number of traps fished in the study area was 233,675. The maximum legal number that could be fished was 315,275; the potential increase in trap number for the southern and eastern shores of Nova Scotia including Cape Breton was 81,600 or 25.7%.

A similar analysis of "B" licenced fishermen throughout the study area (Table 3) indicates a potential for an increase of 4,873 traps if maximum number of traps licence^{-1} were utilized. The percent increase ranged from 25.3% (Lunenburg Co.) to 50.6% (Cape Breton Co.); however, this represents only 1.47% of the total number of traps that can legally be fished by both "A" and "B" fishermen.

2. Maximizing days fished

The number of "A" licenced fishermen county^{-1} along with the mean number of days fished season^{-1} county^{-1} derived from interviews is given in Table 4. With the exception of District 4B (6-mo open season) the districts have a 2-mo open season. The number of legal fishing days season^{-1} ranges from 51 in District 5 counties to 155 in District 4 counties. An estimate is made of realistic numbers of fishing days district^{-1} by discounting Sundays, storm days and for District 4, days not fished during the winter. These estimates range from 41 in District 5 counties to 53 in District 4 counties. The number of fishermen county^{-1} times the realistic estimate of boat fishing days gives an estimate of boat fishing days season^{-1} that could be utilized. The actual number of boat fishing days county^{-1} calculated from our interviews is somewhat less; this provides for a potential increase of 10.4% in Victoria Co. to 30.6% in Queens Co. Based on our estimate of realistic numbers of boat fishing days the overall potential for increase is 18.2%.

3. Upgrading fishing gear, including vessels

Data on fishing gear quality are unavailable, i.e. buoy and rope type and age of traps. The data available by county, on vessel length and accessories, are presented in Table 5. Mean boat length (m) ranged from 7.6 ± 0.4 m (Guysborough Co.) to 8.8 ± 0.4 m (Lunenburg/Queens Co.). The difference was not significant (P=0.05). Of interest is that 24.0% of the lobster boats in the study area are 6.1 m and under; 69.2% are under 9.1 m; and 2.3% are 12.1 m and over. The only size restrictions on new lobster boats is in District 4 (max. 13.7 m).

Mean boat age ranged from 5.9 yr (Victoria Co.) to 12.2 yr (Guysborough Co.), but the difference was not significant (P=0.05).

The bulk (64.7%) of the boats in the study area had gasoline inboard engines; 12.7% had diesel; 20.4% employed gasoline outboards; and 2.3% were man powered. The percentage of vessels with gasoline inboards ranged from 56.9% (Halifax Co.) to 77.8% (Richmond Co.); with gasoline outboards ranged from 11.1% (Richmond Co.) to 33.3% (Guysborough Co.); and with diesels ranged from 4.2% (Guysborough Co.) to 17.2% (Halifax Co.). The bulk (78.8%) of the vessels in the study area were equipped with power-operated haulers; 53.8% were non hydraulic; and 24.4% were hydraulic. Thus, 21.2% of the fishermen hauled their traps by hand. The percentage of vessels by county with hydraulic haulers ranged from 20.8% (Guysborough Co.) to 84.4% (Victoria Co.); with non-hydraulic haulers ranged from 3.1% (Victoria Co.) to 54.2% (Guysborough Co.); and without mechanical haulers ranged from 11.1% (Richmond Co.) to 27.6% (Halifax Co.).

The two navigational aids, Loran and radar, were present in only 12.7% and 27.6% of the boats respectively in the study area. Loran was not present in any boats in Guysborough Co. but 20% of the vessels in Cape Breton Co. had it. Regarding radar, 5.6% of the vessels of Richmond Co. were so equipped, whereas 52.6% of the vessels out of Lunenburg/Queens Co. employed radar.

Surprisingly, only 52.6% of the vessels in the study area were equipped with sounders; the number without sounders per county ranged from 61.1% (Richmond Co.) to 44.7% (Lunenburg/Queens Co.).

4. Maximizing deckhand assistance

Throughout the study area the majority of vessels (64.3%) did not employ deckhands; 34.8% employed one and 0.9% employed two. The number of vessels without deckhands ranged from 84.2% (Lunenburg/Queens Co.) to 40.6% (Victoria Co.) (Table 5); the number that employed one deckhand ranged from 15.8% (Lunenburg/Que

Co.) to 53.1% (Victoria Co.). Victoria was the only county where two deckhands were employed (6.2%).

Fishing Power

Data were not available on either those soak times or trap distribution that would maximize CPUE. The fishermen in the study area employed salt bait (14.3%), fresh bait (39.6%), or a combination of both (46.1%). The most frequently used bait species was mackerel (75.9%); 9.5% of the fishermen used herring; 6.3% used flatfish; 4.5% used gaspereau; 2.3% used redfish; and 0.5% used other species.

The percentage of fishermen county^{-1} that employed salt or fresh bait, or a combination of both, is given in Table 6. The percentage that used salt bait ranged from 3.1% (Victoria Co.) to 23.2% (Halifax Co.); the percentage that used fresh bait ranged from 16.7% (Richmond Co.) to 62.2% (Lunenburg/Queens Co.); and the percentage that used a combination of both ranged from 29.7% (Lunenburg/Queens Co.) to 62.5% (Victoria Co.).

Discussion

An increase in lobster landings in Cape Breton and Victoria Co. began about 1979 (see Campbell and Mohn 1983 for annual landings). Landings in Richmond Co. increased in 1981. However, landings up to 1981 for the counties of Queens, Lunenburg, Halifax, and Guysborough had shown a steady decline since the early 1960's. Landings for 1982 increased in the latter counties judging from our interview data and preliminary statistics (Table 1); the percentage of fishermen that experienced increased landings ranged from 71.1% to 95.5%. Throughout the total study area (Queens Co. east to Victoria Co.) 71.6% suggested improved landings.

Although little is known regarding the overall density of lobsters in the study area a number of recruitment theories were developed to explain the decline in lobster landings. They were as follows: a reduction in larval recruits due to the Canso Causeway (Dadswell 1979 and Harding et al. 1983); recruitment overharvesting resulting in increased sea urchin densities which destroyed lobster habitat (Wharton and Mann 1981); and recruitment overharvesting only in an area where there were no brood stock refugia (Robinson 1979).

Regardless of which of the above theories is correct we have no reason to believe this upturn in landings is more than temporary. We assume that conservation of the brood stock is important and high levels of exploitation are detrimental to conservation.

The present analysis suggests that there is considerable latent fishing effort within the lobster fishery of the study area (Fig. 2 and 3). The calculated potential for increase in daily number of traps alone is 25.7% or 81,600 traps (Table 2). During our survey, fishermen in all counties were building new traps and adding to their trap number. Many claimed this was the first time they had done this in years. Some were building large traps for the first time. There was a significant difference ($P<0.05$) between counties in the mean number of traps fished day^{-1}. Fishermen in Victoria and Cape Breton Co. (these two counties plus Richmond Co. will hereafter be referred to as the "island counties") fished nearly 100 more traps day^{-1} than did fishermen in Lunenburg/Queens and Halifax Co. (these counties plus Guysborough Co. will hereafter be referred to as the "mainland counties").

The latent potential to increase fishing effort by increasing the mean number of days fished $season^{-1}$ is difficult to assess. This is due to the inability to accurately assess the mean number of days $season^{-1}$ that fishermen do not fish when weather conditions would permit fishing (an attempt at this was made in Table 4). The potential to fish under adverse conditions is no doubt linked to vessel construction, vessel navigational aids, quality of fishing gear, and previous fishing success. Nevertheless, although the legal maximum number of fishing days $season^{-1}$ $county^{-1}$ is similar (Table 4) there was a significant ($P<0.05$) difference in the mean number of days fished between certain counties. Fishermen from the island counties fished significantly more days $season^{-1}$ than did fishermen from mainland counties. Of interest, fishermen from those counties (Lunenburg/Queens) where the legal number of days $season^{-1}$ is higher fished significantly fewer than fishermen from all other counties (Fig. 3).

Mainland fishermen likely have more storm-bound days than the island fishermen; their season begins earlier in the spring. The quality of mainland equipment might be a factor as well. There was no significant difference ($P=0.05$) in either boat length or boat age between counties. There were differences in types of vessel power and trap-hauling methods. Mainland county fishermen have about 10% more outboard-powered vessels (presumably less powerful than inboards), about 12% more vessels without trap haulers, and 24% more vessels without deckhands than island fishermen (Table 5).

Thus, it can be concluded that effort can be increased substantially in all counties within the framework of the present regulations. There is no need to increase the legal maximum number of fishing days $season^{-1}$, increase the legal maximum number of traps per licence, nor increase the number of licences in any of the counties. Indeed, it may be unfortunate for the rebuilding of the stocks that there is this latent

effort available within the fishery. If Campbell and Robinson (1983) are correct in their assessment of a reduced reproductive potential and their conclusion that there are no refugia of brood stock throughout the study area, then a sustained recovery is unlikely. This pulse in recruitment for the mainland counties as determined by the large percentage of fishermen who had an increase in fishing success (Table 1) may have been due to a relaxation of fishing pressure over the last 10 yr or so. Many fishermen left the fishery through retirement, and their licences were sold to the government during the "buyback" program (this survey). Many fished fewer traps and fewer days per season (Fig. 2 and 3). Thus, the exploitation rates [exploitation rates are thought to be high in all Maritime lobster stocks - between 70% and 95% (Anthony and Caddy 1980)] may have declined over the last 10 to 15 yr. Lower exploitation rates would increase the reproductive potential of the stocks; more eggs might yield more larvae and hence more juveniles and adults. More adults leads to increased fishing success; the latter (this may be where we are now in the stocks of the mainland counties) will lead to an increase in fishing effort by individual licencees and ultimately to both a reduction in reproductive potential and stock density.

Another aspect that should be noted is the distribution of fishing effort. Each interviewee was chosen randomly from throughout the total study area. Thus, the distribution of interviewees (Fig. 1) should represent the quantitative distribution of licenced fishermen. If this is the case then there appear to be refugia for brood stock in northern Halifax Co., central Guysborough Co., northern Richmond Co., and southern Cape Breton Co. Data are available from the survey to verify this hypothesis. In the interim these apparent refugia should be maintained until their biological significance has been determined.

Conclusions

1. Landings increased in Victoria and Cape Breton Co. in 1979, in Richmond Co. in 1980, and in Queens/Lunenburg, Halifax, and Guysborough Co. in about 1982.

2. Lobster populations cannot yet be defined nor is much known regarding source of population recruitment, population structure, and population density.

3. The cause of the crash of the lobster fishery along Nova Scotia's eastern and southern shores is under debate but it could be due to: 1) recruitment overharvesting; and/or 2) the stoppage in flow of lobster larvae through Canso Strait and a cooling trend.

4. Any recruitment to the lobster fishery will probably be subjected to additional fishing pressure given the amount of latent effort.

5. There is considerable latent fishing effort in all counties from Queens Co. east to Victoria Co. but particularly in those counties south of Chedabucto Bay.

6. Exploitation rates may have declined over the past 10 to 15 yr in those lobster stocks south of Chedabucto Bay and north of Shelburne Co.

Recommendations

1. That research continue and possibly be enhanced to permit: 1) the determination of lobster population(s) from Queens Co. east to Victoria Co.; and 2) the determination of both population structure and population densities in this area.

2. That exploitation rates be determined for the population(s) from Queens Co. east to Victoria Co.

3. That lobster fishing regulations, covering that area from Queens Co. east to Victoria Co., not be changed in such a way as to allow an increase in lobster fishing effort. All should be done to discourage an increase over present effort levels. This should include the use of present latent effort.

Acknowledgements

Needless to say, this study would have been impossible without the cooperation of the fishermen along Nova Scotia's southern and eastern shores (including eastern Cape Breton). To a man they were helpful, cooperative, and showed interest in the study. We do hope that their time spent will be translated into a more profitable fishery for them. A special thanks to all the wives of the fishermen who frequently ensured that coffee or tea and sweets were available; some even offered lunch and supper! This thoughtfulness made the task even more pleasant for us. A number of others were involved with the study; we thank them for their contribution: John Stairs for assisting with the interviews; Robert Semple for data analysis; Glyn Sharp for guidance; Trish Helm and Paul Thibodeau for drafting and table preparation; and Marcia Guy for typing the manuscript. The manuscript benefitted from review by Drs. Robert Miller and Robert Mohn.

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Table 1. The percentage of fishermen in each county along Nova Scotia's southern and eastern shores that estimated an increase, a decrease, or a steady state in their lobster landings. Survey done in the spring of 1983.

County	Estimate of catch trends (%)			
	Increase	Decrease	Steady	Ratio of: increase/steady-decrease
Victoria	46.9	6.3	46.9	0.88
Cape Breton	66.7	2.6	30.8	2.00
Richmond	50.0	0.0	44.4	1.13
Guysborough	95.5	0.0	4.5	21.2
Halifax	84.5	5.2	10.3	5.45
Lunenburg/Queens	71.1	10.5	18.4	2.46

Table 2. The potential increase in fishing effort (total traps) for "A" licenced fishermen in the southern and eastern counties of Nova Scotia.

County	No. licenced fishermen	Maximum legal no. traps/ licence	Mean no. traps fished per licence	Potential total traps per county	Estimated no. traps fished	Potential increase (no. traps)	Potential % increase in traps per county
Victoria	190	275	236	52,250	44,878	7,372	14.1
Cape Breton	235	275	242	64,625	56,870	7,755	12.0
Richmond 6A/7A	18/62	250/275	203.6/177.8	4,500/17,050	3,664.8/11,022.2	835.2/6,027.8	18.5/35.4
Guysborough 7A/5B	4/130	275/250	177.8/191.7	1,100/32,500	711.2/24,921	388.8/7,579	35.3/23.3
Halifax	290	250	159.3	72,500	46,197	26,303	36.3
Lunenburg	196	250	151.7	49,000	29,733.2	19,226.8	39.3
Queens	87	250	180.2	21,750	15,677.4	6,072.6	27.9
Total:	1,212			315,275	233,674.8	81,560.2	25.7

Table 3. Potential increase in fishing effort (total traps) for "B" licenced fishermen in the southern and eastern counties of Nova Scotia.

County	No. licenced fishermen	Maximum legal no. traps/ licence	Mean no. traps fished per licence	Potential total traps per county	Estimated no. traps fished	Potential increase (no. traps)	Potential % increase of traps per county
Victoria	13	83	58.8	10,790	760.5	318.5	29.5
Cape Breton	42	83	41	3,486	1,722	1,764	56.6
Richmond 6A/7A	2/4	75/83	86.5	150/332	173/346	?/?	?
Guysborough 7A/5B	11/13	83/75	75	913/975	825/975	88/0	9.6/0
Halifax	16/32	75/75	52.5/50	1,200/2,400	840/1,600	360/800	30/33.3
Lunenburg	55	75	56	4,125	3,080	1,045	25.3
Queens	23	75	53.3	1,725	1,226.7	498.3	28.9
Total:	211			26,096	11,548.2	4,873.8	29.5

Table 4. The potential increase in fishing effort (boat days) for the southern and eastern counties of Nova Scotia.

County	No. licenced fishermen	Legal no. days fished/ year/ licence	Estimated realistic no. legal fishing days	Mean no. days fished/ year	Potential no. boat fishing days	Realistic est. no. boat fishing days	Present est. no. boat fishing days	Potential % increase in boat fishing days
Victoria	190	52	45	40.3	9,880	8,550	7,657	10.4
Cape Breton	235	52	45	39.6	12,220	10,575	9,306	12
Richmond 6A/7A	18/62	52/56	45/44	34.6	936/3,472	810/2,728	622.6/2,145.2	23.1/21.4
Guysborough 7A/5B	4/130	56/51	44/41	30.7	224/6,630	176/5,330	122.8/3,991	30.2/25.1
Halifax 5A/4B	156/134	51/155	41/53	40.8	7,956/20,770	6,396/7,102	6,364.8/5,467.2	0.5/23.0
Lunenburg	196	155	53	39.8	30,380	10,388	7,800.8	24.9
Queens	87	155	53	36.8	13,485	4,611	3,201.6	30.6
Total:	1,212					56,666	46,679.2	18.2

Table 5. Characteristics of lobster fishing boats in the southern and eastern counties of Nova Scotia.

County	Boat length (m) (± SE)	Engine type (%)			Hauler type (%)			Loran (% without)	Radar (% without)	Sounder (% without)	Deckhands (% with)			Licence (% class)	
		Gas.	Dsl.	Obd.	Hyd.	Mec.	None				0	1	2	A	B
Victoria	8.3 ± .3	75.0	9.4	15.6	84.4	3.1	12.5	93.8	84.4	50.0	40.6	53.1	6.2	90.6	9.4
Cape Breton	8.8 ± .4	67.5	12.5	17.5	65.0	20.0	15.0	80.0	70.0	45.0	52.5	47.5	0.0	92.5	7.5
Richmond	8.3 ± .4	77.8	11.1	11.1	50.0	38.9	11.1	94.4	94.4	61.1	66.7	33.3	0.0	88.9	11.1
Guysborough	7.6 ± .4	62.5	4.2	33.3	20.8	54.2	25.0	100.0	87.5	45.8	83.3	16.7	0.0	95.8	4.2
Halifax	8.1 ± .3	56.9	17.2	22.4	50.0	22.4	27.6	84.5	70.7	44.8	62.1	37.9	0.0	89.7	10.3
Lunenburg/Queens	8.8 ± .4	63.2	13.2	18.4	42.1	31.6	26.3	84.2	47.4	44.7	84.2	15.8	0.0	76.3	23.7

Table 6. The percentage of fresh or salted bait used by southern and eastern shore Nova Scotia lobster fishermen.

County	Percent bait freshness		
	Salted	Fresh	Both
Victoria	3.1	34.4	62.5
Cape Breton	17.5	30.0	52.5
Richmond	22.2	16.7	61.1
Guysborough	8.3	54.2	37.5
Halifax	23.2	35.7	41.1
Lunenburg/Queens	8.1	62.2	29.7

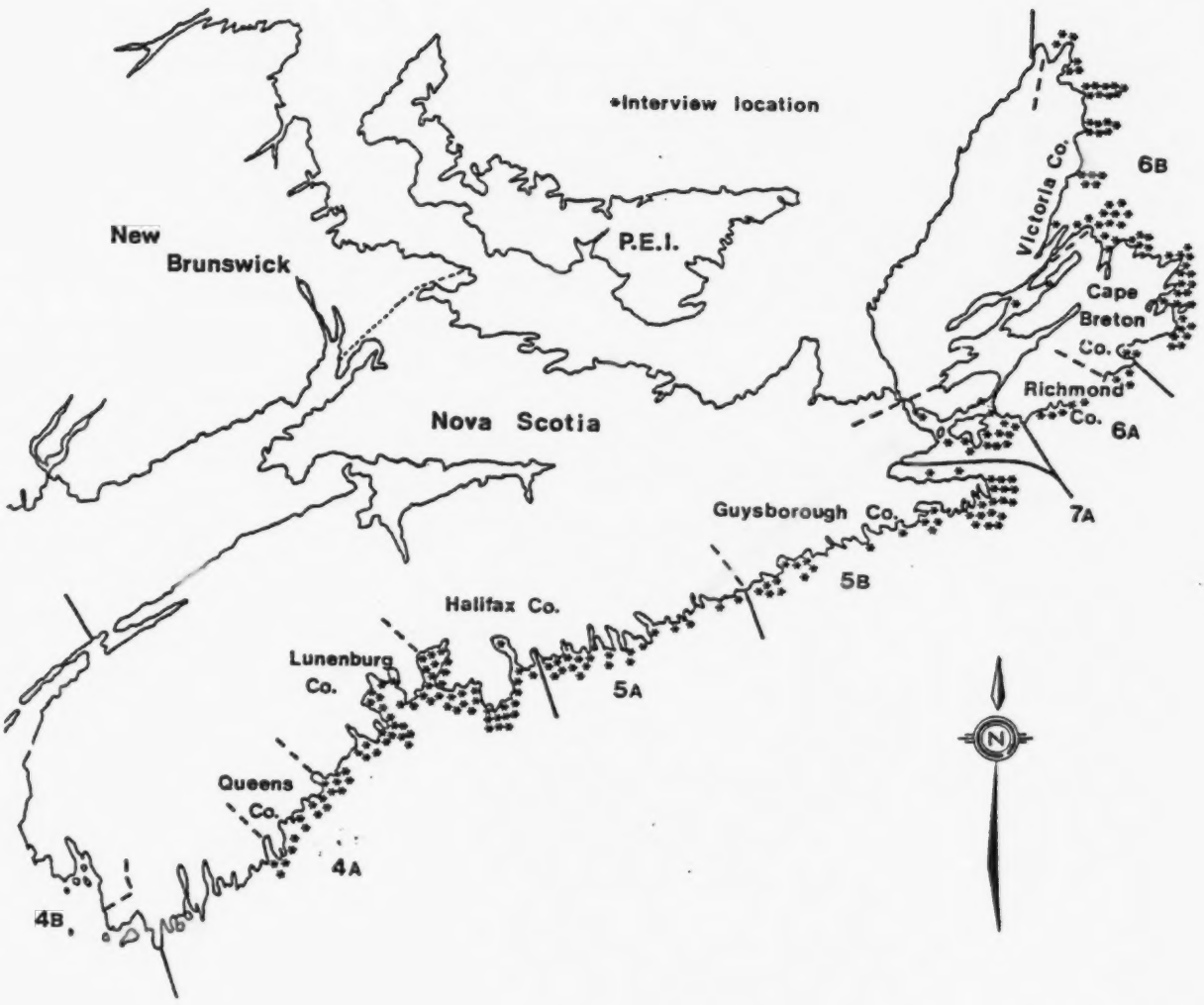

Fig. 1. Distribution of fishermen interviewed from Queens Co. to Victoria Co. during the winter of 1982/83.

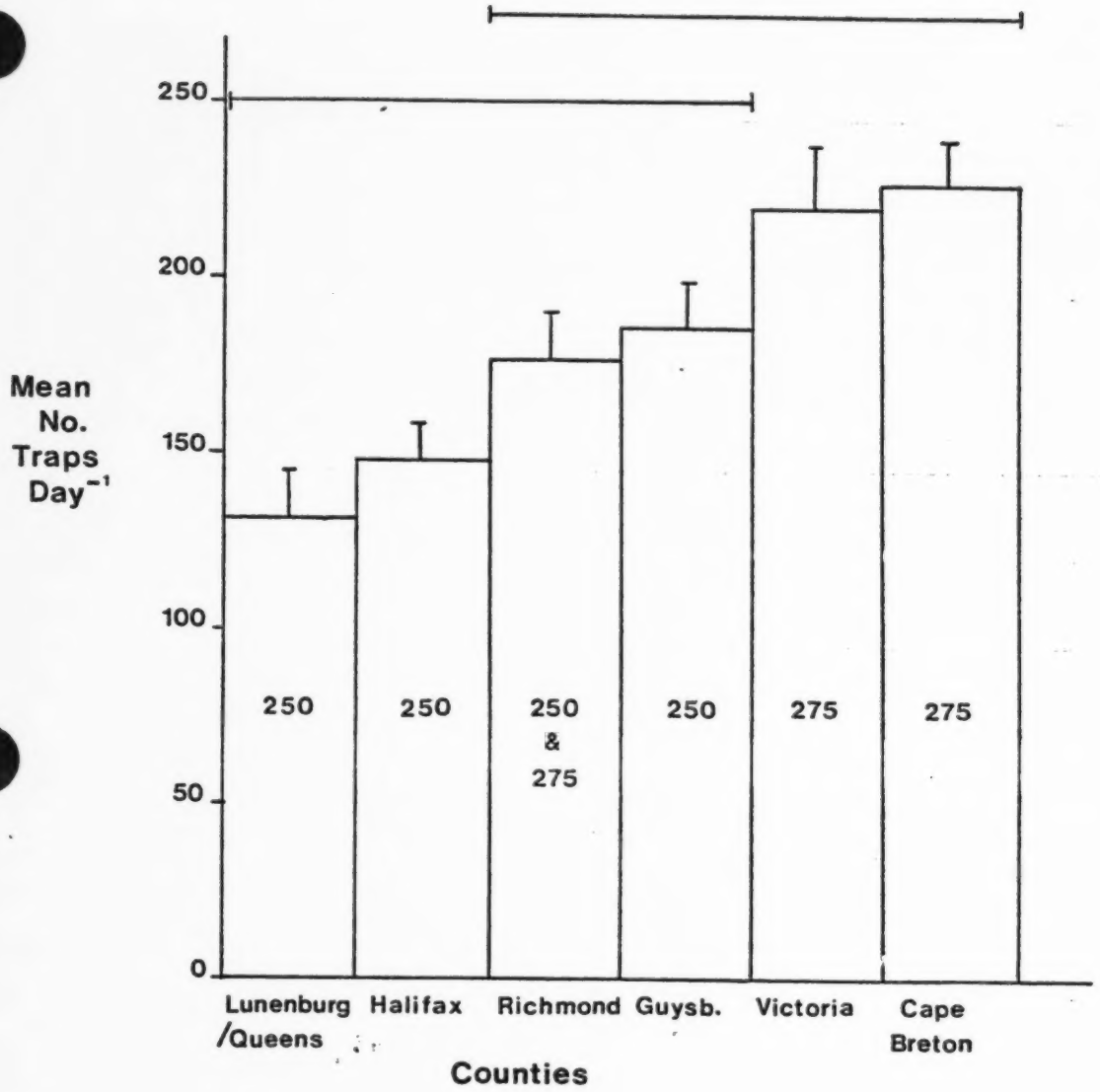

Fig. 2. Mean no. traps fished da^{-1} co.$^{-1}$ lobster license^{-1}. Vertical lines = $\pm$ 1 SE; horizontal lines = test of significance $P = 0.95$. The number in the bar represents the legal maximum number of lobster traps permitted per lobster license.

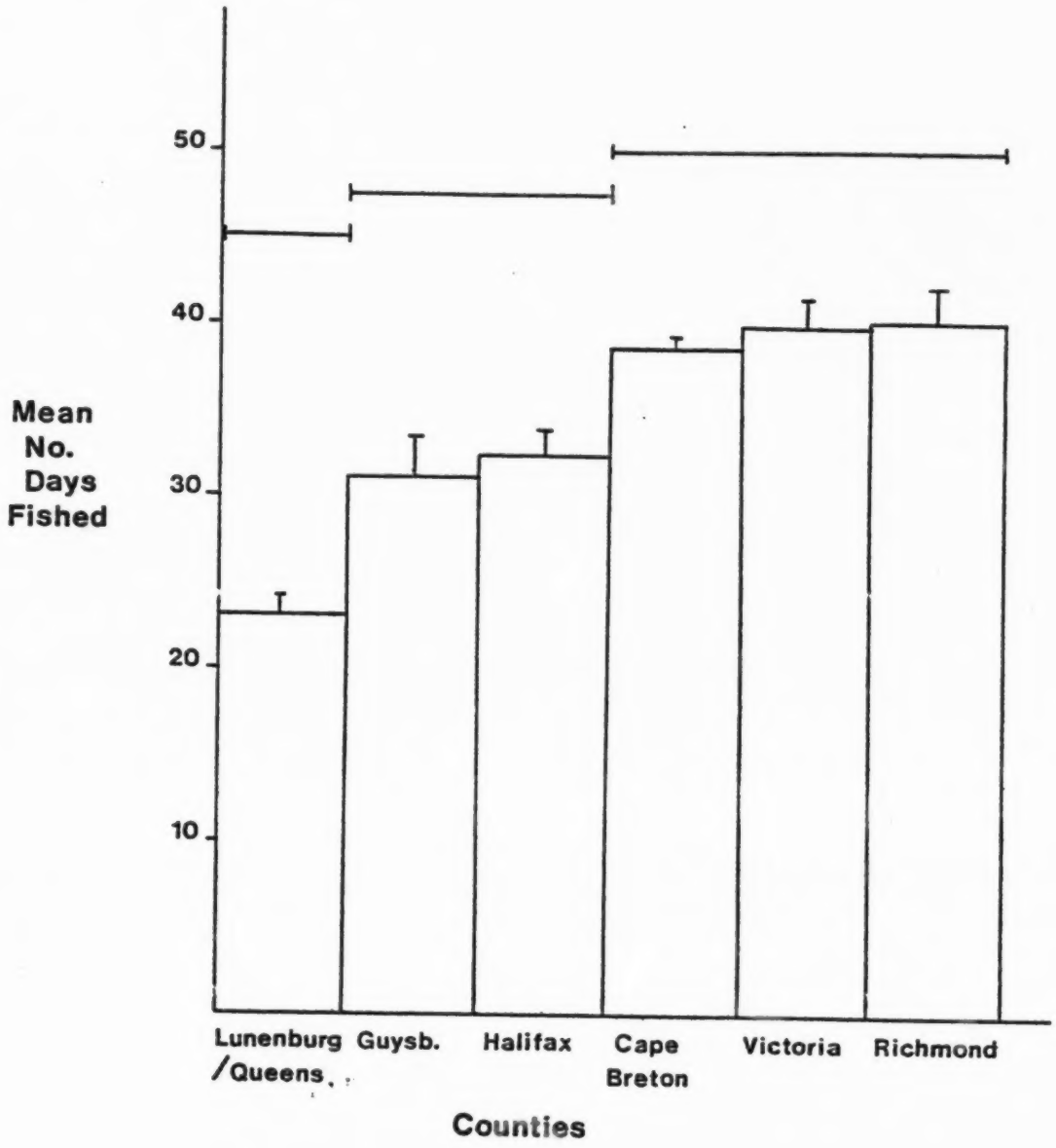

Fig. 3. Mean no. days fished season^{-1} co.$^{-1}$. Vertical lines = $\pm$ 1 SE; horizontal lines = test of significance (P = 0.05).

Appendix 1. 1982-83 lobster landings - preliminary figures (Statistics Division, Management Services Branch, Scotia-Fundy Region).

District	Volume (t)		%	Value ($,000)		Licence Value ($)		$
	1982	1983		1982	1983	1982	1983	
4A	4,052	4,828	+19.2	27,762	35,580	28,800	36,900	+28.3
4B	484	737	+52.3	3,262	5,376	4,300	7,100	+65.0
5	164	242	+47.6	816	1,425	2,600	4,600	+77.0
6A/7A	99	125	+26.3	507	695	3,700	6,400	+73.0
6B	1,226	1,658	+35.2	5,622	8,250	10,900	16,000	+46.4

Appendix 2. Questionnaire recording form. Last 5 questions related to other projects.

(1-4) Port: _____

(5-6) Lobster district: _____

(7-8) Years fishing: _____

(9) Boat construction: _____

(10-11) Boat age: _____

(12-13) Boat length: _____

(14) Engine type: _____

(15) Hauler type: _____

(16) Loran: _____

(17) Radar: _____

(18) Sounder: _____

(19) Radio: _____

(21-22) No. helpers (spring/fall): _____

(23-24) Min. depth fished: _____

(25-26) Max. depth fished: _____

(27-32) Fishing area (miles) E, W, Off.: _____

(33) License class: _____

(34-36) Traps fished: _____

(37-38) No. days fished - spring: _____

(39-40) No. days fished - fall: _____

(42) No. bows/trap: _____

(43) No. entrance rings: _____

(44) Wire, net, both: _____

(45-47) Trap length: _____

(48-49) Trap width: _____

(50-51) Trap height: _____

(52-53) Lath space: _____

(54-56) Hoop size: _____

(58) Bait type - spring: _____

(59) (Salt or fresh) - fall: _____

(60-62) Bait species (preferred): _____

(63-65) % bait bought: _____

(66-68) % bait caught: _____

(69) Lobster catch trend: _____

(70-72) % catch own use: _____

No. cod/day: _____

Kelp on lobster grounds (year): _____

When last seen: _____

When first seen: _____

Sea urchins: _____

Comments:

- Date
- Problems or concerns
- Opinion of license Buy-Back Program

Appendix 3. Questions asked interviewees. To be used in conjunction with Appendix 2.

Port - Coded by Stat. District and name.
Lobster District - Coded by number: A = 1, B = 2.
Years fishing :- How long have your held a lobster fishing licence?
Boat age - Since built, not since bought?
Boat length - What is overall length of your lobster boat?
Engine type :- Gasoline, diesel, outboard, absent?
Hauler type - Mechanical, hydraulic, absent?
Loran - Present, absent?
Radar - Present, absent?
Sounder - Present, absent?
Radio - C.B., VHF, both, none?
helpers (spring-fall) :- How many full season helpers hired?
Minimum depth fished - What is shallowest depth gear set in?
Maximum depth fished - What is deepest depth gear set in?
Fishing area :- From your wharf, how far do you travel, east, west and offshore to fish traps?
Licence class :- "A" or "B"?
Traps fished - How many traps do you actually fish, averaged over last 2-3 yr?
days fished spring-fall - How many days/season (average last 2-3 yr) did you fish when 80% or more of traps were hauled?
Trap data - Average recorded from actual observation and measurement of 10 traps.
Bait type - spring fall :- Do you use salt, fresh, or combination of both types of bait?
Bait species - What are the main kinds of fish used for bait, in decreasing order?
% bait bought - What portion of your bait do you buy (average last 2-3 yr)?
% bait bought - What portion of your bait do you manage to obtain on your own (average last 2-3 yr)?
Catch trend - Has your catch increased, decreased, remained steady this year compared to average of last 2-3 yr?
% catch own use :- What percentage of your catch do you keep for your own use (average last 2-3 yr)?